2. THE PROPOSED ACTION AND ALTERNATIVES

This section discusses the proposed action, the no-action alternative (including three scenarios that are reasonably expected to result as a consequence of the no-action alternative), and alternatives dismissed from further consideration.

2.1 PROPOSED ACTION

The proposed action is for DOE to provide support through cost-shared funding for the design, construction, and demonstration of CFB combustion technology for electric power generation at a size sufficient to allow utilities to make decisions regarding commercialization of the technology. Specifically, DOE will decide on providing approximately $73 million (about 24% of the total cost of approximately $309 million) to demonstrate CFB technology at JEA's Northside Generating Station in Jacksonville, Florida. The new CFB combustor would use coal and petroleum coke to generate nearly 300 MW of electricity by repowering the existing Unit 2 steam turbine, a 297.5-MW unit that has not operated since 1983. In doing so, the proposed project is expected to demonstrate emission levels of SO_2, NO_x, and particulate matter that would be lower than CAA limits while at the same time producing power more efficiently and at less cost than conventional technologies using coal. The proposed action as described in the following sections is DOE's preferred alternative.

2.1.1 Project Location and Background

The site for the proposed project is located in Jacksonville, Florida, about 9 miles northeast of the downtown area, at the existing Northside Generating Station (Figure 2.1.1). This 400-acre industrial site is situated along the north shore of the St. Johns River, approximately 10 miles west of the Atlantic Ocean. The local terrain is flat and there is a mix of industrial, commercial, residential, and agricultural land use in the vicinity. The most striking environmental feature associated with the area is the nearby presence of estuarine salt marsh backwaters of the St. Johns River.

The main entrance to Northside Generating Station is from Heckscher Drive, which runs east-west along the site's southern border (Figure 2.1.2). Route 9A, a divided highway, runs north-south near the site's western border, and Interstate 95 and U.S. Highway 17, two major north-south thoroughfares, are located about 6 miles west of the site. The industrial 1,650-acre St. Johns River Power Park borders Northside Generating Station to the northeast, and the 46,000-acre Timucuan Ecological and Historic Preserve borders the site to the east. Blount Island, located immediately to the southeast in the St. Johns River, is a major port with facilities for docking, loading, and unloading large ocean-going vessels.

Existing steam generation units, combustion turbine units, and associated infrastructure currently occupy about 200 acres of the 400-acre Northside Generating Station property. The property contains a number of wetland areas, especially in the perimeter areas. The proposed project and related

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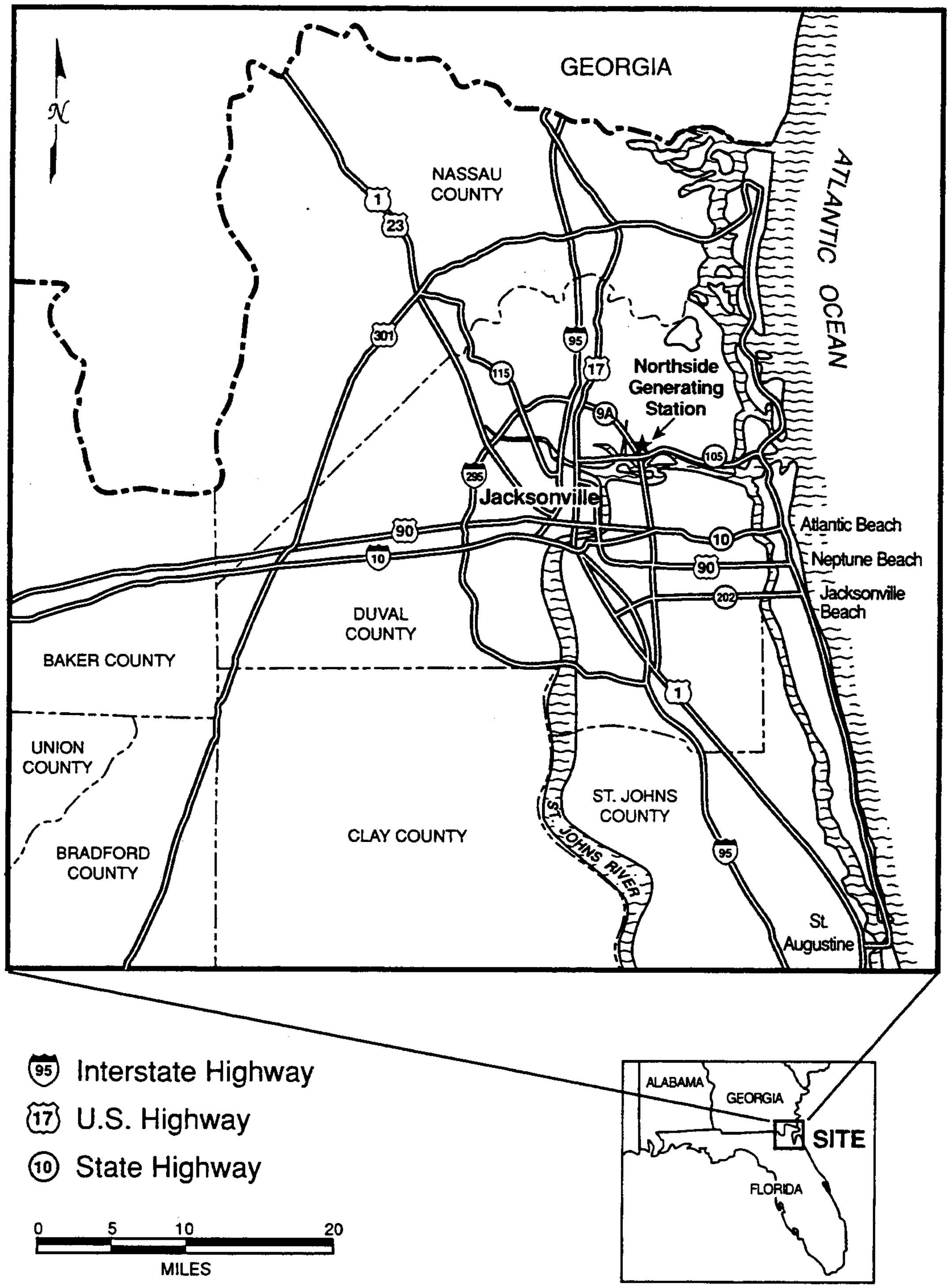
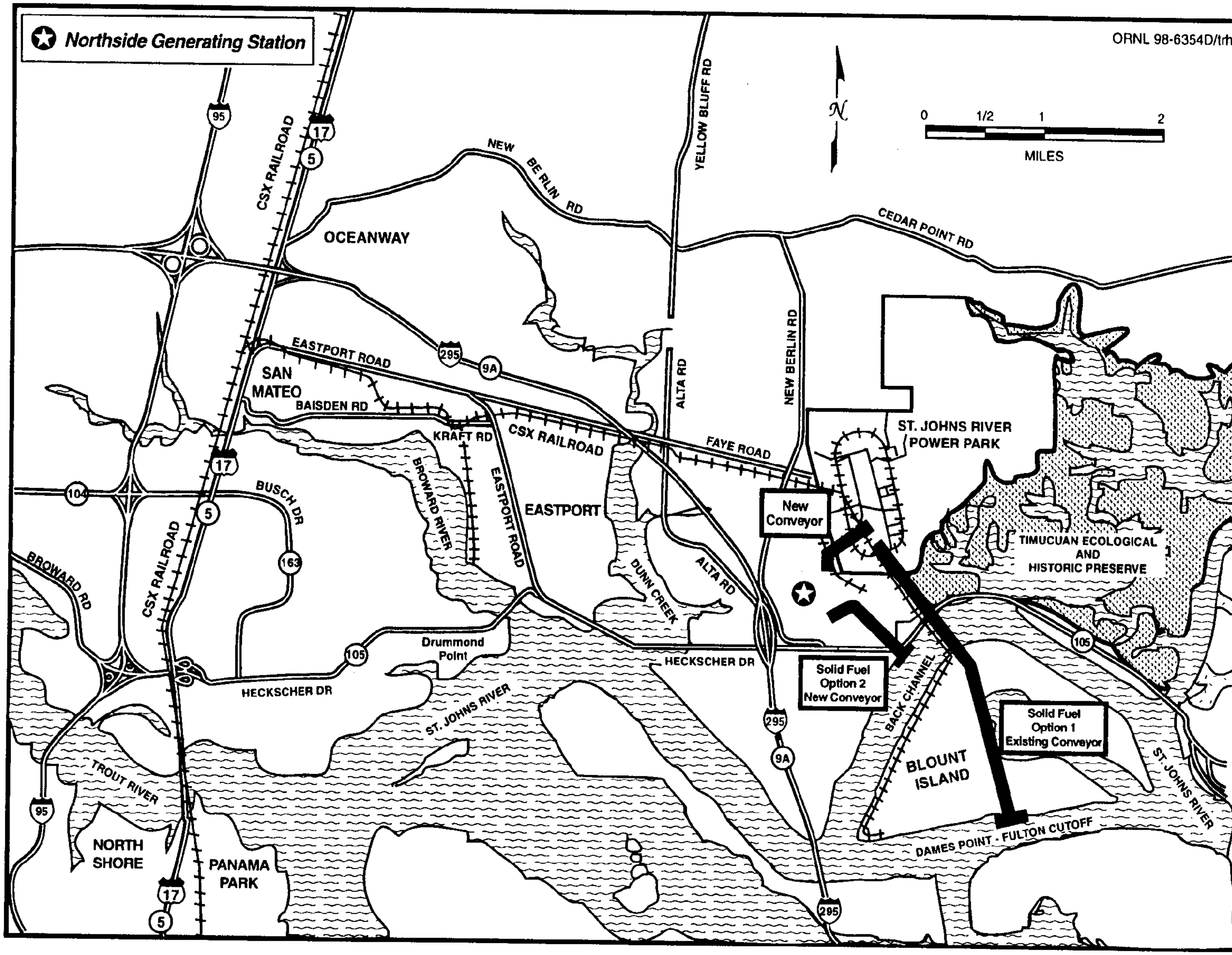


Figure 2.1.1. Regional location map for the proposed circulating fluidized bed combustor project.



Northside Generating Station
ORNL 98-6354D/trh
N
0
1/2
1
2
MILES
OCEANWAY
SAN MATEO
EASTPORT
NORTH SHORE
PANAMA PARK
BLOUNT ISLAND
ST. JOHNS RIVER POWER PARK
TIMUCUAN ECOLOGICAL AND HISTORIC PRESERVE
New Conveyor
Solid Fuel Option 2 New Conveyor
Solid Fuel Option 1 Existing Conveyor
CSX RAILROAD
NEW BERLIN RD
YELLOW BLUFF RD
CEDAR POINT RD
EASTPORT ROAD
BAISDEN RD
KRAFT RD
FAYE ROAD
ALTA RD
NEW BERLIN RD
BUSCH DR
BROWARD RIVER
EASTPORT ROAD
DUNN CREEK
BROWARD RD
HECKSCHER DR
Drummond Point
ST. JOHNS RIVER
TROUT RIVER
BACK CHANNEL
DAMES POINT - FULTON CUTOFF
95
17
5
295
9A
104
163
105

Figure 2.1.2. Proposed site of the circulating fluidized bed combustor project.

infrastructure would occupy about 75 acres of the property. The CFB combustor would be located immediately to the west of the existing Unit 3 on a section of the property that currently consists primarily of a covered parking lot for employees (Figure 2.1.3). Piping and related infrastructure would be constructed to link the new CFB combustor with the existing Unit 2 steam turbine.

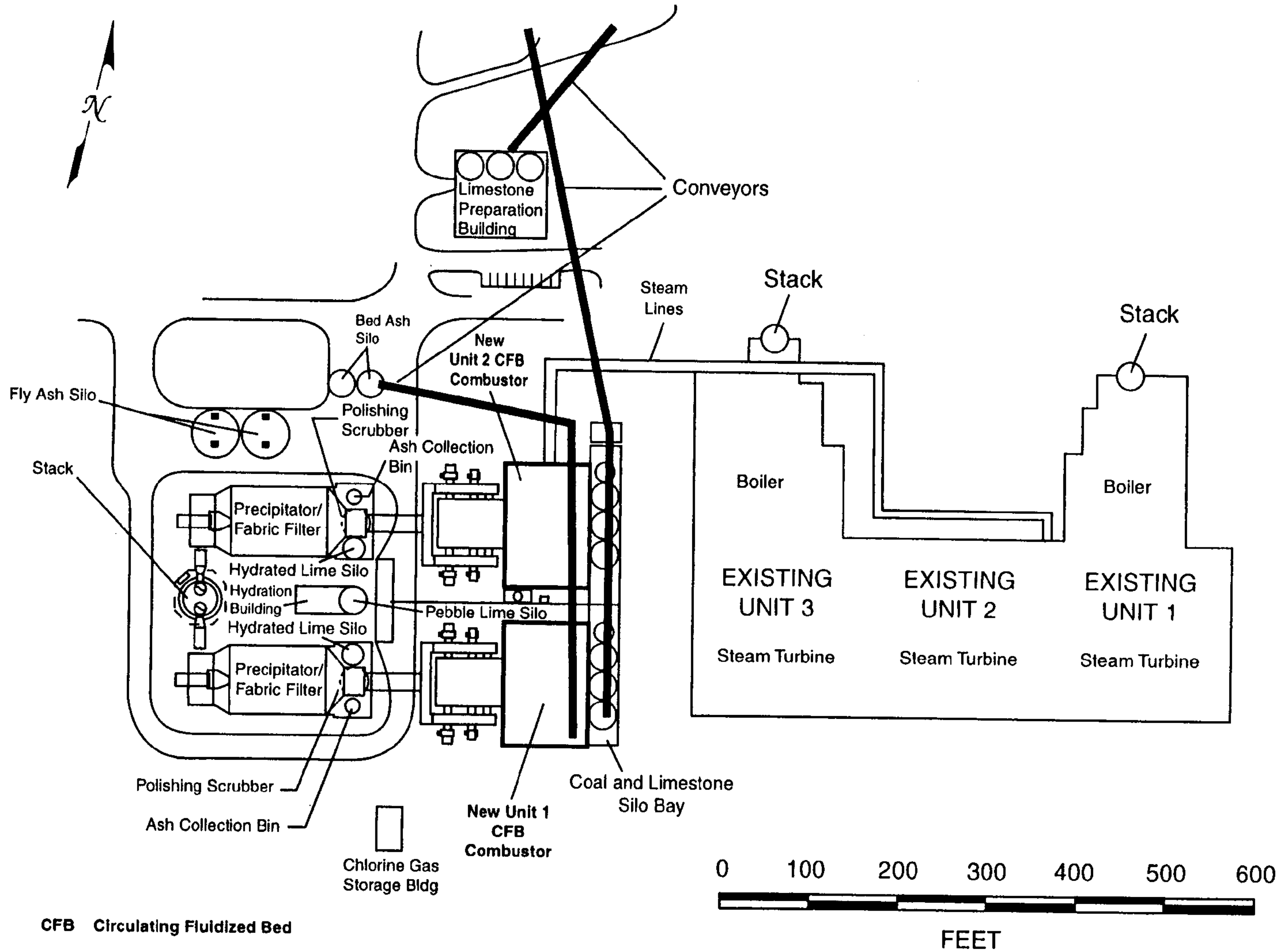
Northside Generating Station has operated since November 1966 when the 297.5-MW Unit 1 came on-line. The 297.5-MW Unit 2 and the 564-MW Unit 3 started operation in March 1972 and June 1977, respectively. Unit 2 has been out of service since 1983 because of major boiler problems associated with the volume of its furnace being inadequate to accommodate the heat generated. The Unit 2 steam turbine is currently idle and the Unit 2 furnace and stack have recently been dismantled and removed. Units 1 and 3 currently operate at a capacity factor of between 30 and 40% because they are more costly to operate than other units in the JEA system. Northside Generating Station employs 265 people, including a pool of 105 operations workers and a pool of 126 maintenance workers who are stationed at Northside but are assigned daily tasks at other JEA facilities in addition to Northside. The remaining 34 workers at Northside are managers, engineers, and administrators for the JEA system of power plants.

All three units were designed with the capability of using both oil and natural gas for fuel. However, all units began operation with infrastructure capable of using No. 6 fuel oil only; Units 1 and 3 were modified later so that they can burn both natural gas and oil [No. 6 fuel oil or No. 2 fuel oil (diesel)]. Each unit has multiple burners that are capable of burning either natural gas or oil alone at any given time; fuel blending flexibility for each unit is attained by varying the number of burners using each fuel. Blending is dictated by economic and air emission considerations. Units 1 and 3 have no air pollution control with the exception of low-NO_x burners on Unit 3. Once-through cooling water is withdrawn from and discharged into the St. Johns River. In addition to Units 1 and 3, 4 diesel-fired 52.5-MW combustion turbines that operate to meet peak demand are located at Northside Generating Station.

In the mid-1970s, the U.S. Army Corps of Engineers (COE) designed and constructed a 40-acre dredge spoil area on Northside Generating Station property (Figure 3.4.2). The COE has used this area to dispose of sediment dredged from the bottom of the back channel of the St. Johns River (Figure 2.1.2). Periodic dredging to maintain channel depth has been conducted at the existing Northside Generating Station fuel oil unloading dock.

The adjacent St. Johns River Power Park (Figure 2.1.2), a power plant which has operated since 1986, is a joint venture between JEA and Florida Power & Light. JEA and Florida Power & Light each receive approximately 50% of the electricity generated. The twin 660-MW units are fueled with coal and petroleum coke, with coal comprising at least 80% of the fuel blend. The units were designed to use coal with a 4% sulfur content, but they currently are using 1% sulfur coal. Wet limestone scrubbers are used for SO_2 control, and electrostatic precipitators are used for particulate control.

Currently, all of the gypsum (generated by the scrubbers) and bottom ash (produced by the combustors) is sold, as is some of the fly ash (captured by the electrostatic precipitators). The Power



CFB **Circulating Fluidized Bed**

Figure 2.1.3. Location of the proposed circulating fluidized bed combustor project in relation to the existing Northside Generating Station power block.

Park uses two natural-draft cooling towers with a water discharge system that is integrated into the Northside Generating Station's system (i.e., make-up water needed by the cooling towers is drawn from the Northside discharge of once-through cooling water, and blowdown from the cooling towers is added to the Northside discharge of once-through cooling water; circulating pumps direct the flow of water to prevent the blowdown from being recycled as make-up water).

2.1.2 Technology Description

CFB technology is an advanced method for burning coal and other fuels efficiently while removing air emissions inside the sophisticated combustor system. CFB technology provides flexibility in utility operations because a wide variety of solid fuels can be used, including high-sulfur, high-ash coal and petroleum coke. Figure 2.1.4 is a generalized diagram of the primary components in the CFB combustion process. Figure 2.1.5 is an artist's conception of key equipment for the technology.

In a CFB combustor, coal or other fuels, air, and crushed limestone or other sorbents are injected into the lower portion of the combustor for initial burning of the fuel. The combustion actually occurs in a bed of fuel, sorbent, and ash particles that are fluidized by air nozzles in the bottom of the combustor. The air expands the bed, creates turbulence for enhanced mixing, and provides most of the oxygen necessary for combustion of the fuel. As the fuel particles decrease in size through combustion and breakage, they are transported higher in the combustor where additional air is injected. As the particles continue to decrease in size, unreacted fuel, ash, and fine limestone particles are swept out of the combustor, collected in a particle separator (also called a cyclone), and recycled to the lower portion of the combustor. This is the "circulating" nature of the combustor. Drains in the bottom of the combustor remove a fraction of the bed composed primarily of ash while new fuel and sorbent are added. The combustion ash is suitable for beneficial uses such as road construction material, agricultural fertilizer, and reclaiming surface mining areas.

The limestone captures up to 98% of the sulfur impurities released from the fuel (DOE 1996). When heated in the CFB combustor, the limestone, consisting primarily of calcium carbonate ($CaCO_3$), converts to calcium oxide (CaO) and CO_2. The CaO reacts with the SO_2 from the burning fuel to form calcium sulfate ($CaSO_4$), an inert material that is removed with the combustion ash. The combustion efficiency of the CFB combustor allows the fuel to be burned at a relatively low temperature of about 1,650°F, thus reducing NO_x formation by approximately 60% compared with conventional coal-fired technologies (DOE 1996). Greater than 99% of particulate emissions in the flue gas are removed downstream of the combustor by either an electrostatic precipitator or a fabric filter (baghouse).

The heated combustor converts water in tubes lining the combustor's walls to high pressure steam. The steam is then superheated in tube bundles placed in the solids circulating stream and the flue gas stream. The superheated steam drives a steam turbine-generator to produce electricity in a conventional steam cycle.

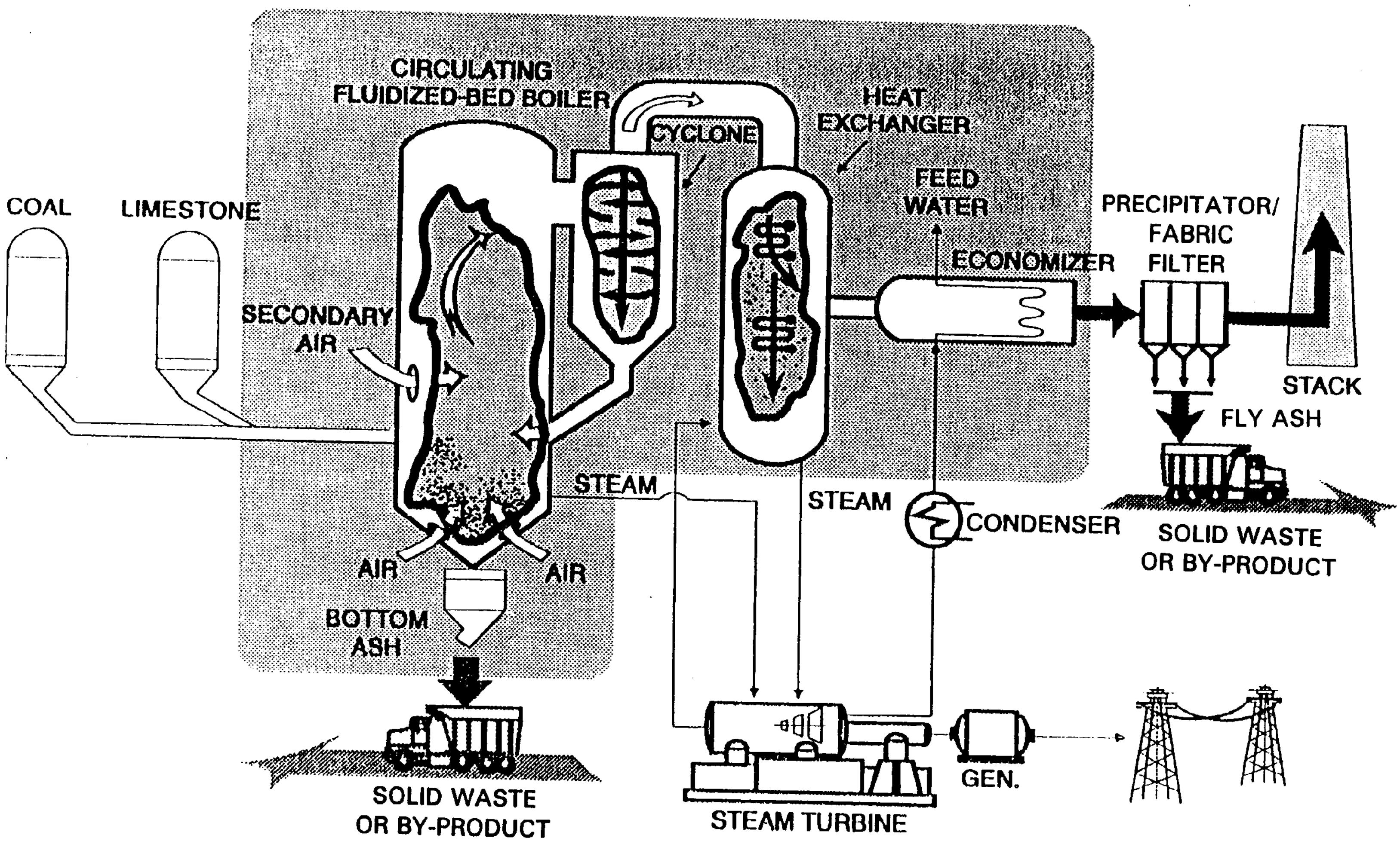

CIRCULATING
FLUIDIZED-BED BOILER
CYCLONE
HEAT
EXCHANGER
FEED
WATER
COAL
LIMESTONE
PRECIPITATOR/
FABRIC
FILTER
ECONOMIZER
SECONDARY
AIR
STACK
FLY ASH
STEAM
STEAM
CONDENSER
SOLID WASTE
OR BY-PRODUCT
AIR
AIR
BOTTOM
ASH
SOLID WASTE
OR BY-PRODUCT
GEN.
STEAM TURBINE

Figure 2.1.4. A generalized diagram of the primary components in the circulating fluidized bed combustion process.

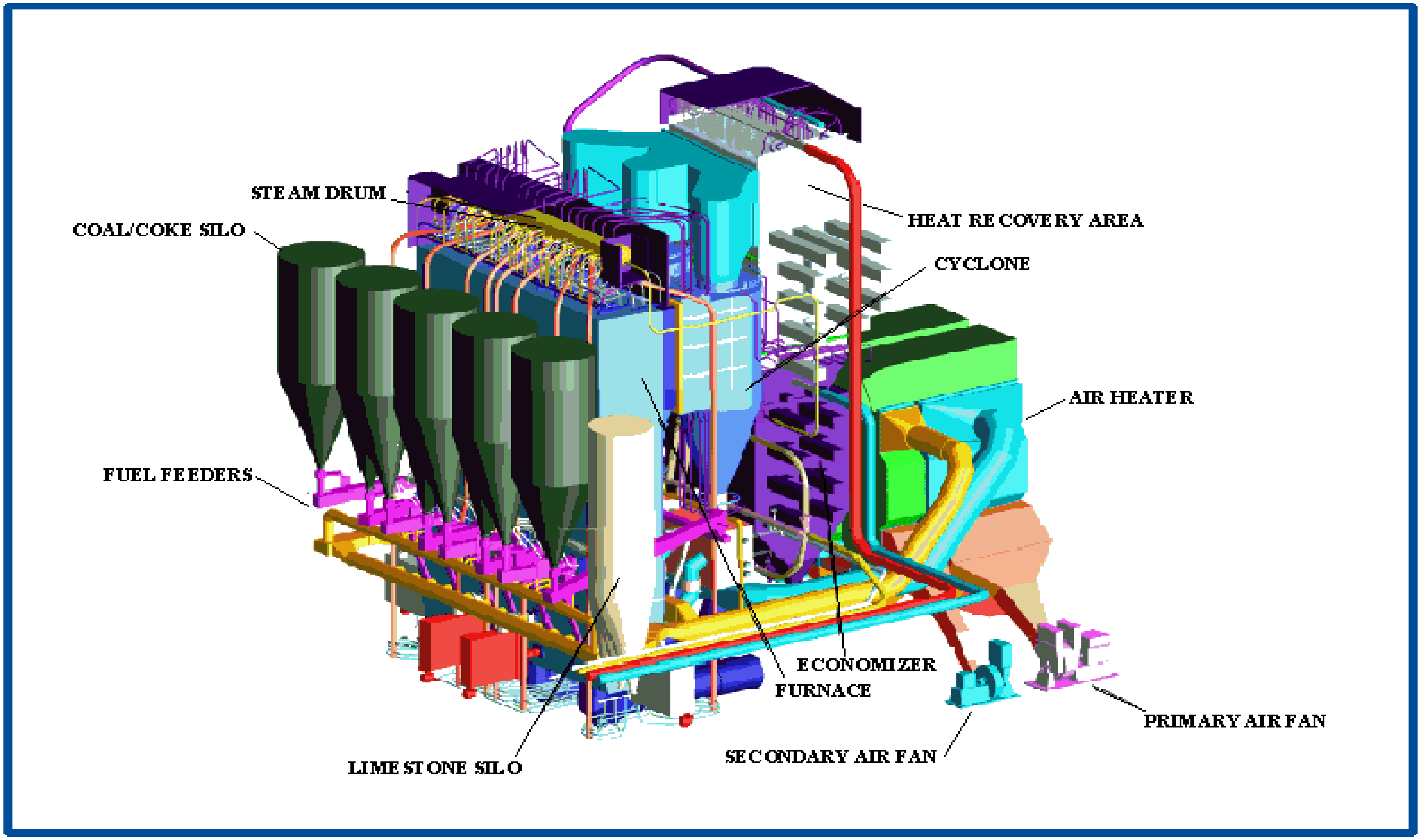

STEAM DRUM
COAL/COKE SILO
HEAT RECOVERY AREA
CYCLONE
AIR HEATER
FUEL FEEDERS
ECONOMIZER
FURNACE
PRIMARY AIR FAN
SECONDARY AIR FAN
LIMESTONE SILO

Figure 2.1.5. Artist's conception of key equipment for the circulating fluidized bed technology.

A CFB combustor has several advantageous operating characteristics that differentiate it from more conventional technologies. Because the fuel and sorbent being added represent only a fraction of the total fuel and sorbent available in the bed, the combustor reacts more slowly to variations in fuel or sorbent quality. Steam characteristics and furnace temperatures are more uniform, which usually results in easier operation, fewer upset conditions and emission spikes, and more consistency in the quality of combustion ash. As a consequence of bed fluidization and recycling of particles back to the lower portion of the combustor, enhanced mixing is achieved at more uniform temperatures, which allows more complete combustion and sorbent reaction. Another advantage of the combustor is the efficient transfer of heat due to the physical contact between the particles in the bed and the heat exchanger tubes in the walls. The technology also has lower operating and maintenance costs and a shorter "down time" for maintenance than conventional coal-fired technologies.

2.1.3 Project Description

The proposed CFB combustor project would incorporate the technology described in Section 2.1.2 into the repowering of the existing 297.5-MW Unit 2 steam turbine at Northside Generating Station. The related action of repowering the currently operating Unit 1 steam turbine is discussed in Section 2.2. One addition to the CFB technology described above is that the proposed project would use a polishing scrubber in combination with the CFB combustor to attain a 98% SO_2 removal rate. The polishing scrubber is a conventional scrubbing system that would use lime in a dry flue gas desulfurization process downstream of the combustor to convert SO_2 chemically to calcium sulfite and calcium sulfate. It is called a polishing scrubber because the CFB combustor would remove 85–90% of the SO_2 and the polishing scrubber would remove or "polish off" the remainder. This design is driven by economic rather than technical considerations (i.e., the CFB combustor alone could achieve a 98% SO_2 removal rate but the operating cost would be greater).

Another addition to the CFB combustion technology is that the proposed project would use a selective non-catalytic reduction system to further reduce NO_x emissions. Aqueous ammonia, the reagent for this system, would be injected into the CFB combustor exhaust gas to convert NO_x emissions to nitrogen gas and water via a chemical reduction reaction. Atmospheric emissions of ammonia can occur if the amount supplied to reduce NO_x in the flue gas is not used up (ammonia slip). However, excess ammonia in the stack gas can typically be reduced to a level in the parts per million by optimizing the amount of ammonia that is injected. For the proposed project, stack emissions of ammonia slip would not exceed 40 ppm. Based on technical, environmental, and economic considerations, JEA plans to decide on using an electrostatic precipitator or a fabric filter (baghouse) to remove at least 99.8% of particulate emissions for the proposed project.

The proposed project would generate 50% or less of the emissions allowed by New Source Performance Standards (NSPS). The project's SO_2 limits (based on performance design) would be 0.15 lb/MBtu on a 30-day rolling average (for all periods of 30 consecutive days) and 0.2 lb/MBtu on a 24-hour block average (from midnight to midnight). By comparison, the corresponding NSPS for SO_2 are 1.2 lb/MBtu with a 90% removal rate or 0.6 lb/MBtu with a 70% removal rate, on a 30-day rolling average. The proposed project's NO_x limit would be 0.09 lb/MBtu on a 30-day rolling average, compared to the NSPS of 1.6 lb/MWh (approximately 0.18 lb/MBtu). The proposed particulate limit would be 0.011 lb/MBtu (verified by annual stack testing) compared to the NSPS of 0.03 lb/MBtu, and the opacity limit would be 10% compared to the NSPS of 20%.

The proposed project would use bituminous coal and petroleum coke to generate nearly 300 MW of electricity. After satisfying the power requirements of Northside Generating Station, the power plant would provide electricity to the city of Jacksonville through the local power grid. During the 2-year demonstration, Unit 2 would be operated on several different types and blends of coal and petroleum coke to explore the flexibility of the CFB technology. The coal would be transported by ship (from areas such as Columbia and Venezuela), by train (primarily from the central Appalachian region such as West Virginia and eastern Kentucky), and by a combination of train and ship (train from West Virginia and eastern Kentucky to Newport News, Virginia, and ship from Newport News to Jacksonville). Either rail or ship transport would be capable of supplying all of the coal needs for the proposed project. The petroleum coke would be transported by ship from oil refineries in Venezuela and the Caribbean region. Petroleum coke is a high-sulfur, high-energy product having the appearance of coal. Refineries produce petroleum coke by heating and removing volatile organic compounds (VOCs) from the residue remaining after the refining process. Limestone for the CFB combustor would be transported by ship from areas such as the Caribbean region and the Yucatan Peninsula of Mexico to Northside Generating Station, or to the waterfront area of Jacksonville and then trucked to the station. With respect to the frequency of occurrence of the various modes of transportation, current economic projections indicate that marine transport would be the primary means of delivering solid fuel and limestone for the proposed project. The lime for the polishing scrubber would be trucked from a supplier within the southeastern United States.

Wherever possible, existing facilities and infrastructure located at Northside Generating Station would be used for the proposed project. These include the discharge system for cooling water to the St. Johns River, the wastewater treatment system, the water chlorination system, and the electric transmission lines and towers. The existing Unit 2 steam turbine would be refurbished prior to its return to service because it has not been used since 1983. Overhaul and/or modifications would also be performed to existing systems, such as the condensate and feedwater systems, circulating water systems, water treatment systems, plant electrical distribution systems, the switchyard, and the control systems. Unit 3 and the 4 combustion turbines would continue in operation without modification.

Major new facilities that would be constructed include the CFB combustor building, solid fuel delivery and storage facilities, limestone preparation and storage facilities, lime silo, polishing scrubber, 495-ft flue gas stack, and ash removal and storage facilities (Figure 2.1.3). A computerized drawing of the proposed CFB combustor facilities superimposed on a photograph of the existing Northside Generating Station is shown in Figure 2.1.6.

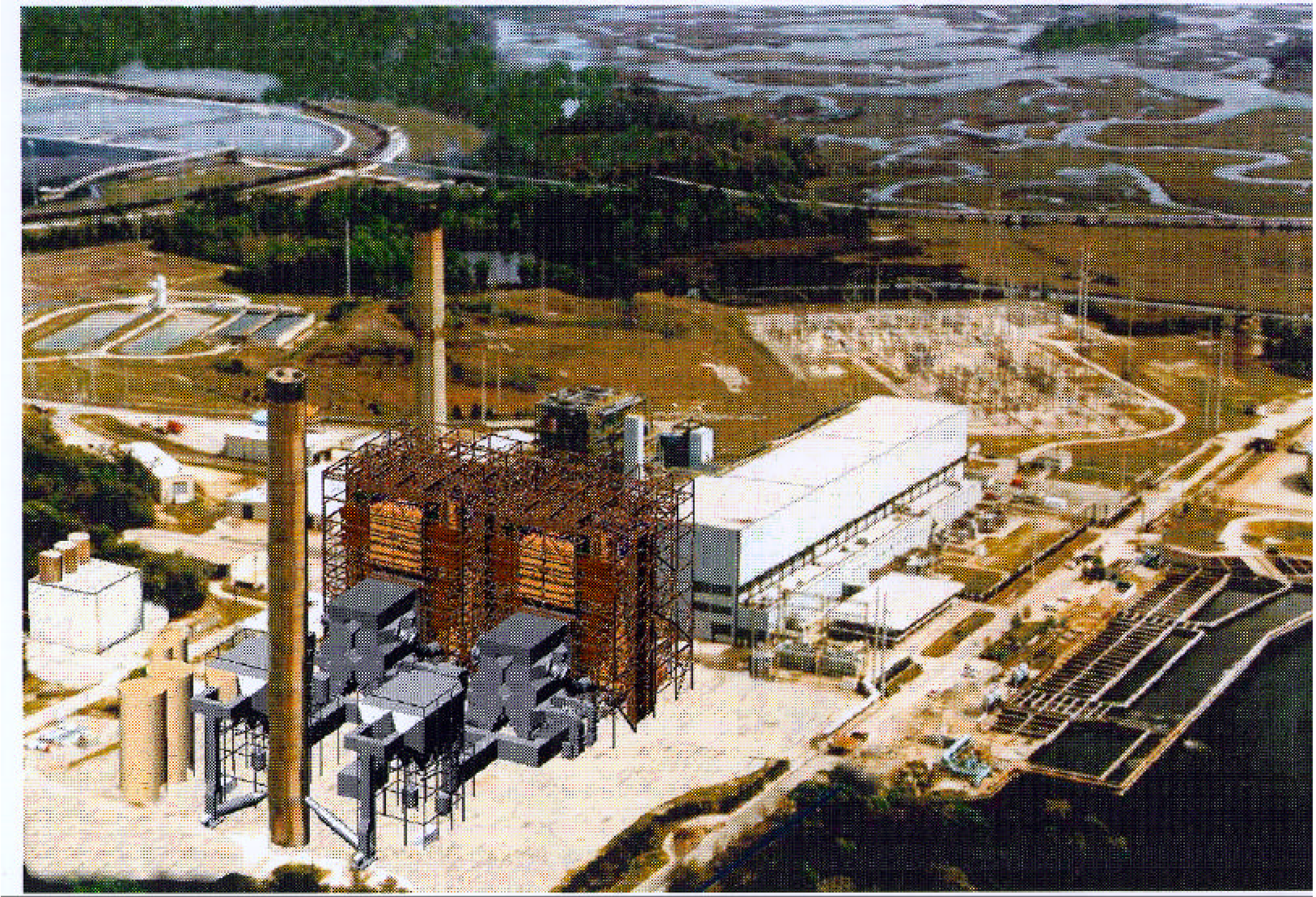


Figure 2.1.6. A computerized drawing of the proposed facilities superimposed on a photograph of the existing Northside Generating Station with the existing Unit 1 combustor and stack removed (view is to the northeast).

JEA is considering two options for handling the waterborne delivery of solid fuel and limestone (Figure 2.1.7). Option 1 is to construct a second unloader at the existing St. Johns River coal terminal that receives coal and petroleum coke delivered by ship and conveys the fuel to the St. Johns River Power Park. Two unloaders at the terminal would provide sufficient capacity to meet the future requirements of both the proposed project and the existing Power Park. Limestone delivered by ship to the coal terminal (rather than to the waterfront area of Jacksonville) would also be unloaded and transported by conveyor. The existing conveyor from the terminal to the Power Park transports solid fuel at a rate of 1,500 tons per hour. The speed of the conveyor's belt may be increased to 1,750 tons per hour to handle the additional fuel and/or limestone, but no additional conveyor would be constructed along this corridor. If the conveyor can't handle the additional fuel, new covered fuel storage would be added at the terminal. After the fuel and/or limestone are moved via the existing conveyor to the Power Park, the fuel would be stored at the existing solid fuel yard at the Power Park and then a new conveyor from the Power Park would transport the required fuel quantities to Northside Generating Station. The limestone would be transported on the new conveyor from the Power Park to Northside Generating Station (without storage at the Power Park) and stored as a new uncovered limestone pile. Under Option 1, no land would be purchased and most of the land has previously been disturbed. This option requires that JEA and Florida Power & Light reach an agreement on the new facilities and that the existing conveyor from the terminal to the Power Park is deemed capable of handling the increased load.

Option 2 is to construct a new unloading terminal to receive coal, petroleum coke, and limestone delivered by ship, as part of an upgraded unloading facility that would replace Northside's existing fuel oil unloading dock. A small portion of the existing dock would be removed during construction of the new dock because it would interfere with construction. The remainder of the existing dock would be used during construction for access and staging of materials and then would be demolished following construction of the new dock. During facility operation, solid fuel, limestone, and fuel oil unloading would occur at the new dock, however, only one ship would dock at a time. Dredging associated with the new dock would deepen the channel by an average of 15 ft from its current average depth of 25 ft. Because less siltation would occur at the new dock, located about 100 ft farther from shore, the frequency of dredging required to maintain the depth of the new channel would be reduced compared to the existing dredging frequency. A new elevated conveyor would run adjacent to the existing oil pipelines to transport the solid fuel and limestone from the terminal to Northside Generating Station. A new covered solid fuel storage pile and a new uncovered limestone pile would be required at the station. Under Option 2, no land would be purchased and most of the land has previously been disturbed. All of the petroleum coke and limestone would be delivered by ship to the new unloading terminal. Under either Option 1 or 2, coal delivered by train would be unloaded at the existing receiving facilities at the Power Park and a new conveyor from the Power Park to Northside Generating Station would be required.

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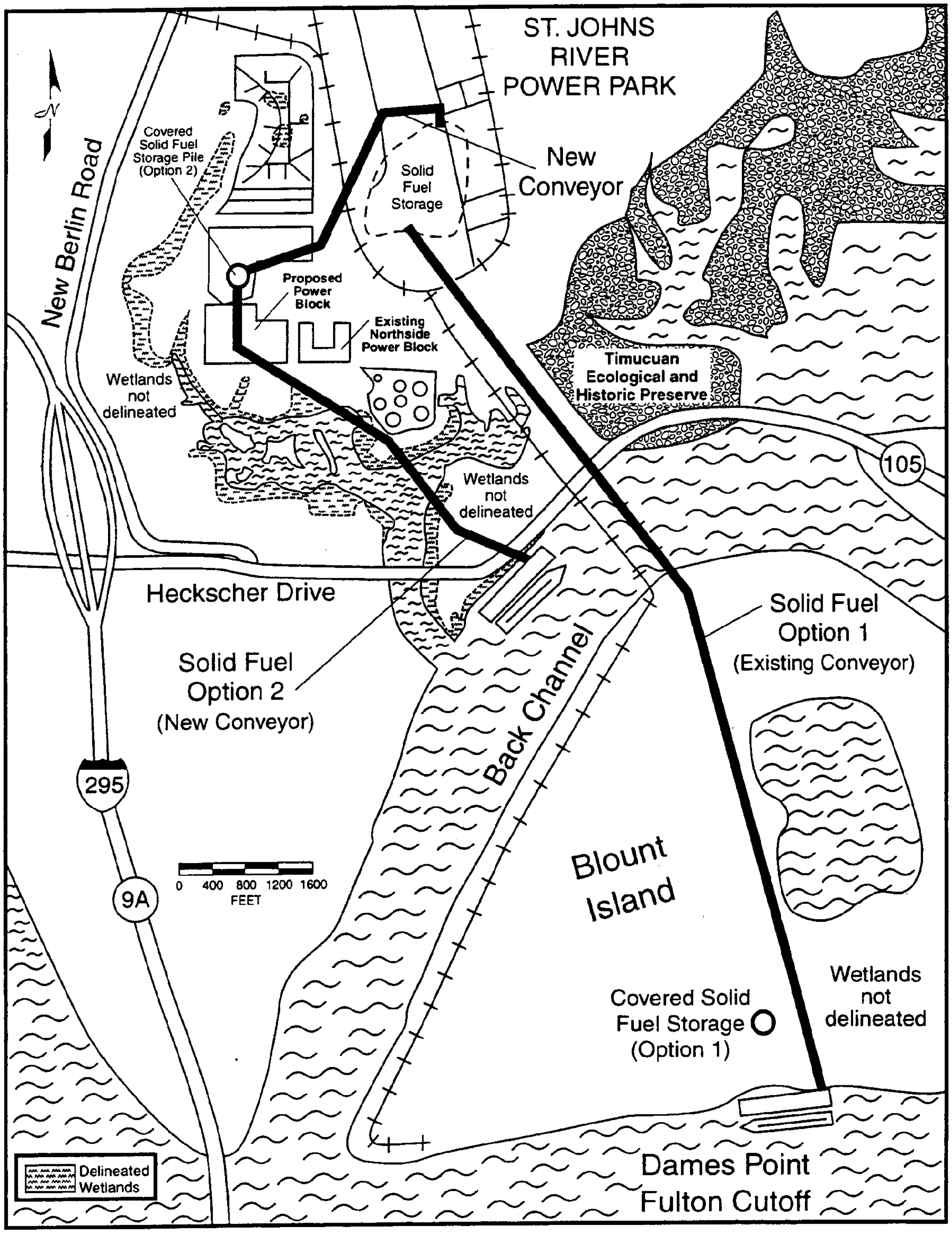


Figure 2.1.7. Map showing the two options for handling the waterborne delivery of solid fuel and limestone and indicating delineated wetlands.

JEA's management has established a target of a 10% reduction in annual stack emissions of each of 3 pollutants (SO_2, NO_x, and particulate matter) from Northside Generating Station (Units 1, 2, and 3), as compared to emissions during a recent typical 2-year operating period (1994–95) of the station (Units 1 and 3). Also targeted for a 10% reduction is the total annual groundwater consumption of Northside Generating Station, as compared to 1996 levels. These reductions are to be accomplished while increasing the total annual energy output of the station from 2,320,000 MWh to 6,220,000 MWh.

Permits and other regulatory compliance issues for the proposed project are discussed in Section 7.

2.1.4 Construction Plans

JEA has indicated that construction may begin without DOE funding prior to the completion of the NEPA process in February 2000 and would continue for more than 2 years until December 2001. Approximately 600 construction workers would be required during the peak construction period. Construction crews would probably work five 8-hour days with the option for four 10-hour days. Construction deliveries (e.g., concrete and small equipment) would normally be made by truck between 9 a.m. and 3 p.m. Major components of the proposed project would be delivered by train. Land requirements during construction and operation are discussed in Section 2.1.6.1.

2.1.5 Operational Plans

Demonstration of the proposed project, including performance testing and monitoring, would be conducted during a 2-year period from March 2002 until March 2004. Following the repowering of Unit 2 and the related action of repowering the existing Unit 1, the total number of employees at Northside Generating Station is expected to decrease by about 10% through attrition from the current level of 265 to about 238 workers (based on projected workforce requirements). Because existing employees would be used to operate and maintain the repowered units, no new employees would be hired by JEA, except for hiring of staff in future years of operation because of further attrition. Although JEA uses pools of employees for its facilities rather than dedicating personnel to particular units, it is expected that there would be a total of approximately 150 full-time equivalent workers at the 2 repowered units, including 74 for operations, 64 for maintenance, and 12 for management, engineering, and administration. The facilities would be staffed with operations workers around the clock plus a maintenance crew working primarily during the daytime.

If the demonstration is successful, commercial operation would follow immediately (Section 5). During commercial operation, the facility would be used as a baseload unit operating 24 hours per day at the 297.5-MW level for 90% of the time during the year. The facility would be designed for a lifetime of 30 years.

2.1.6 Resource Requirements

Table 2.1.1 displays the operating characteristics, including resource requirements, for the proposed project in conjunction with the related action of repowering Unit 1 (Section 2.2) and those of the existing Unit 1 for comparison.

2.1.6.1 Land Area Requirements

Land that would be required temporarily during construction activities includes a total of about 15 acres for equipment/material laydown, storage, assembly of site-fabricated components, construction equipment access, and facilities to be used by the construction workforce (i.e., offices, sanitary facilities, and a construction parking lot). The 400-acre Northside Generating Station, half of which is currently occupied by facilities and infrastructure, should easily accommodate these land requirements.

During operation, the proposed facility would use a total of about 75 acres of land, including 40 acres for ash storage (Section 2.1.7.3). Stormwater and leachate storage ponds would occupy about 11 acres. Newly generated dredge spoil would be added to an existing onsite dredge spoil area (Figure 3.4.2).

The construction area associated with the major facilities for the proposed project's power block would be located on a nearly level 5-acre parcel of land that is partially grassed and has some temporary buildings and sheds that are used to store equipment (Figure 4.1.1). Part of this previously disturbed land also has been paved and is used as a covered parking lot for employees. Therefore, limited site clearing and grading would be required. Three new uncovered, asphalt parking lots occupying a total of about 2 acres would be built to replace the existing parking lot that would be removed prior to construction of the major facilities (Figure 4.1.1). A 10-vehicle lot would be constructed immediately north of the new CFB combustor building, while 30-vehicle and 130-vehicle lots would be built to the east of the existing Unit 1. Under Option 1, about 7 acres of land would be required to expand the existing solid fuel yard at the Power Park and about 1.5 acres would be required for the new conveyor. Under Option 2, about 10 acres of land would be required for the covered solid fuel storage pile at Northside Generating Station and about 3 acres would be required for the new conveyors. Under either option, a new uncovered limestone storage pile would occupy about 2 acres.

2.1.6.2 Water Requirements

Water would be used during construction of the proposed project for various purposes including personal consumption and sanitation, concrete formulation and preparation of other mixtures needed to construct the facilities, equipment washdown, general cleaning, dust suppression, and fire protection. All water used during construction would be supplied from four deep wells that tap the upper Floridan aquifer. Combined potable and service water use during construction would average

Table 2.1.1. Typical operating characteristics for the Northside Generating Station repowered Unit 2, the combination of the repowered Units 1 and 2, and the existing Unit 1

Operating characteristics	Repowered Unit 2	Repowered Units 1 and 2	Existing Unit 1
Generating capacity, MW	297.5	595	297.5
Capacity factor, %[a]	90	90	32
Power production, MWh/year	2,345,490	4,690,980	836,968
Size of Northside Generating Station, acres	400	400	400
Size of project site, acres	75[b]	75	—
Coal consumption, tons/year[c]	912,100	1,824,200	—
Petroleum coke consumption, tons/year[d]	715,820	1,431,640	—
Limestone consumption, tons/year	288,760	577,520	—
Lime consumption, tons/year	3,900	7,800	—
Aqueous ammonia consumption, tons/year	1,648	3,296	—
Natural gas consumption, 10^6 ft^3/year	174[e]	348[e]	2,300[f]
Fuel oil consumption, 10^6 gal/year	0.03[g]	0.06[g]	43[f]
Water use			
Noncontact cooling water, 10^6 gal/day[h]	203	406	203
Treated groundwater, 10^6 gal/day	0.57–0.64[i]	0.57[j]	0.64[j]
Chlorine gas consumption, tons/year	11[i]	11[j]	11[j]
Air emissions			
Sulfur dioxide (SO_2), tons/year	1,650[k]	3,300[k]	5,528[f]
Oxides of nitrogen (NO_x), tons/year	990[k]	1,980[k,l]	1,716[f,l]
Particulate matter (PM-10), tons/year	121[k]	242[k]	394[f]
Carbon monoxide (CO), tons/year	1,533[m]	3,066[m]	153[f]
Volatile organic compounds (VOCs), tons/year	61[m]	122[m]	24[f]
Carbon dioxide (CO_2), tons/year	2,293,100[k]	4,586,200[k]	743,400[f]
Effluents			
Wastewater discharged to St. Johns River, 10^6 gal/day	0.11–0.14[i]	0.14[j]	0.11[j]
Wastewater discharged to evaporation/percolation ponds, 10^6 gal/day	0.027–0.41[i]	0.027[j]	0.41[j]
Noncontact cooling water discharged to St. Johns River, 10^6 gal/day[n]	200	400	200
Heat rejected to St. Johns River, 10^9 Btu/hour	1.3	2.6	1.3
Maximum permitted temperature rise above ambient at the discharge outfall, °F	19	19	19[o]
Solid waste			
Bottom ash, tons/year	105,880[c]–170,411[d]	211,760[c]–340,822[d]	—
Fly ash, tons/year	57,012[c]–109,352[d]	114,024[c]–218,704[d]	—

Table 2.1.1. Concluded

[a]Capacity factor is the ratio of the energy output during a period of time to the energy that would have been produced if the equipment had operated at its maximum power during that period.

[b]Includes the footprint for the new facilities associated with the repowered Unit 1.

[c]Based on using typical coal alone for the entire year.

[d]Based on using typical petroleum coke alone for the entire year.

[e]Based on 3 cold starts and 5 warm starts per year, plus consumption by the limestone dryer of 20,000 ft^3/hour.

[f]Average of the 1994 and 1995 estimated actual values.

[g]Based on 1 cold start and 1 warm start per year.

[h]Unthrottled. Represents allocated portions (based upon generator nameplates) of station 3-unit total flow of 827 Mgd,.

[i]Includes existing Units 1 and 3. Changes in groundwater consumption and wastewater discharges at Northside Generating Station would only be partially realized during the period after Unit 2 is repowered but before Unit 1 is repowered.

[j]Includes existing Unit 3.

[k]Assumed to be 90% of the potential emissions, thereby incorporating the capacity factor. Emissions would be nearly independent of fuel type because emissions controls would be adjusted based on fuel type to achieve the same level of emissions.

[l]JEA is committed to achieving a 10% reduction in annual NO_x emissions at Northside Generating Station. If the reduction is not achieved by the repowering of Units 1 and 2, JEA would attain the reduction by using one or more of the following methods at Unit 3: (1) using more natural gas and less oil; (2) reducing the hours of operation; and (3) installing additional NO_x emission controls.

[m]Because the maximum emission rates occur at minimum load, a proposed annual cap is given rather than incorporating the capacity factor.

[n]Unthrottled. Represents allocated portions (based upon generator nameplates) of station 3-unit discharge to St. Johns River of 815 Mgd.

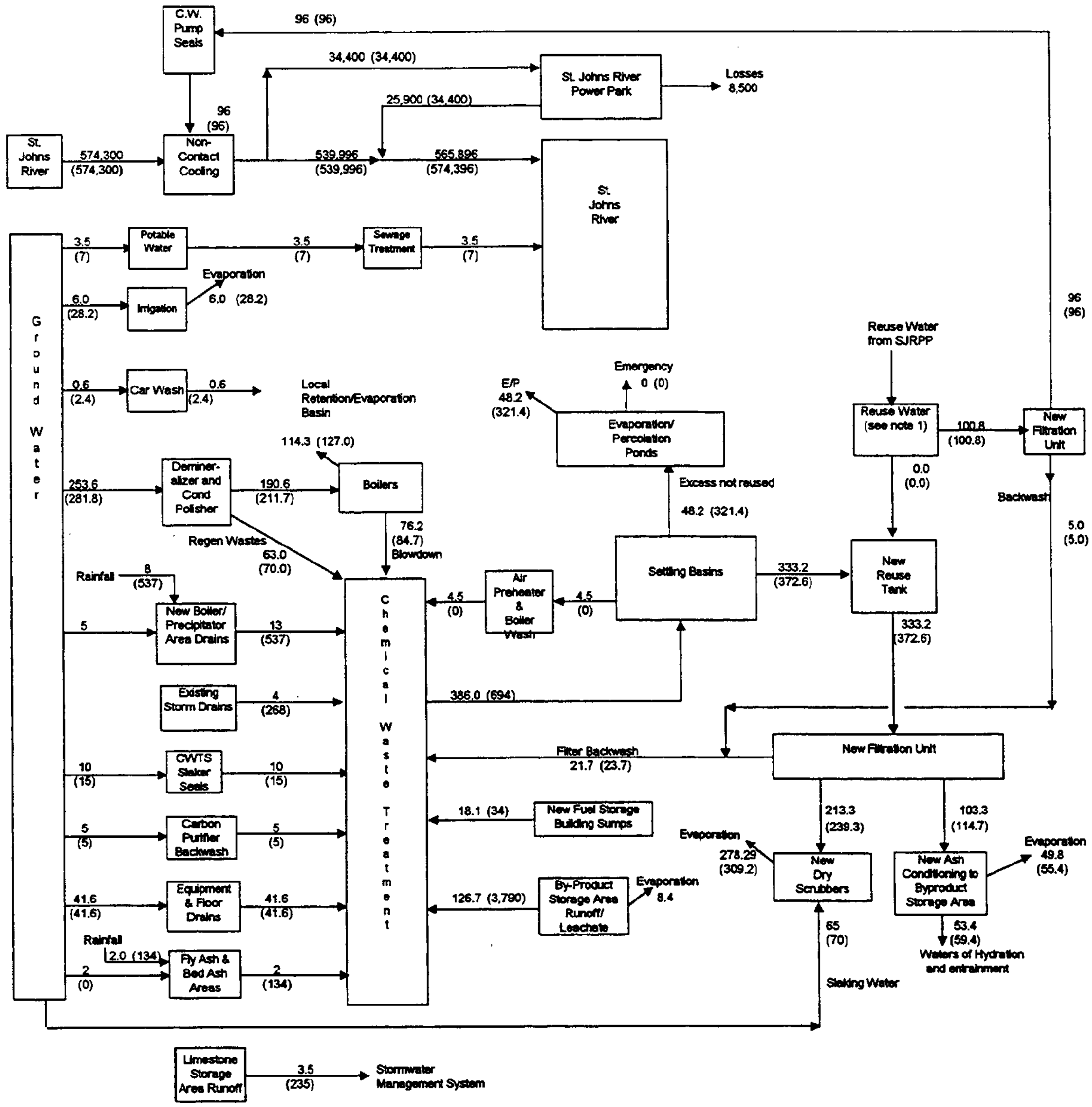
[o]During 1997 and 1998, the average temperature rise at Northside Generating Station was 9°F and the maximum measured temperature rise was 16.6°F.

0.001 Mgd (about 1 gpm). Drinking water also would be provided using bottled water. Portable toilets would minimize requirements for additional sanitary water.

Water for plant operation would be supplied from both the St. Johns River and the four deep wells that tap the upper Floridan aquifer. The total flow of once-through, noncontact cooling water required to operate Northside Generating Station (all 3 units) at full load would average 827 Mgd (574,000 gpm). This cooling water would be drawn from the back channel of the St. Johns River and then 815 Mgd (566,000 gpm) would be returned to the river after passing through the condensers (Figure 2.1.8).

Service water, potable water, process water for generating steam such as boiler makeup, and other Northside Generating Station high-quality water needs would be obtained from the four deep wells. Based on 1996 levels, current average daily consumption of groundwater by both of the existing Units 1 and 3 is 0.64 Mgd (444 gpm). After Units 1 and 2 are repowered, JEA has committed to a 10% reduction in groundwater consumption (based on an annual average as compared to 1996 levels).

The estimated total supply of surface water and groundwater that would be required to operate Northside Generating Station (all 3 units) after repowering is about 827.57 Mgd (575,000 gpm). On an annual basis, the total volume of water that would be supplied is 271,860 million gallons assuming a 90% capacity factor.



Ground Water Total (Avg) = 565,485 gpd

Ground Water Total (Peak) = 657,063 gpd

Northside Generating Station Water Balance (Flows in gpm)
After Repowering, Cells 1 and 2 of Byproduct Storage Area

Note 1: Reuse water planned is SJRPP Plant Effluent.
Note 2: Storm water maximum flows are based on 25-year 24-hour storm.
Note 3: Flows in parentheses represent 24 hour maximum flows.
Note 4: Balance is based on both Cells 1 and 2 of the BSA being in service, with only three ponds available.

Figure 2.1.8. Water flow diagram that depicts water requirements and discharges at

2.1.6.3 Fuel Requirements

The proposed project would be fueled with bituminous coal and petroleum coke. Table 2.1.2 presents an analysis of the composition of the coal and petroleum coke expected to be received for the proposed project. The heating value is expected to be at least 10,000 Btu/lb for the coal and at least 13,000 Btu/lb for the petroleum coke. The percentage of sulfur would range between 0.5 and 4.5% for the coal and between 3 and 8% for the petroleum coke. Assuming a 90% capacity factor and the use of a single fuel (i.e., either coal or petroleum coke alone), the Unit 2 combustor would consume coal at a rate of about 912,100 tons per year or petroleum coke at a rate of about 715,820 tons per year. Each of these amounts would be reduced by 50% by assuming both of these fuels are used equally during the year, including blends of the fuels. Natural gas would be the primary fuel used during cold starts. About 3,120,000 ft^3 would be consumed during a 12-hour start-up prior to beginning the switch to coal and/or petroleum coke. Alternatively, about 23,100 gal of No. 2 fuel oil, the backup start-up fuel, would be consumed during the 12-hour start-up. Approximately four cold starts are expected annually (three cold starts using natural gas and one cold start using No. 2 fuel oil).

2.1.6.4 Construction and Other Materials

Locally obtained construction materials would include crushed stone, sand, and lumber for the proposed facilities and temporary structures such as enclosures, forming, and scaffolding. The facilities would be built using large quantities of structural steel, piping, and concrete. Assuming a 90% capacity factor, annual consumption of limestone, injected into the lower portion of the CFB combustor to remove SO_2, would be approximately 288,760 tons. The maximum annual consumption of lime, used by the polishing scrubber for additional SO_2 removal, would be 3,900 tons. The selective non-catalytic reduction system would inject a maximum of 2,138 tons per year of NO_x reagent into the CFB combustor exhaust gas to convert NO_x emissions to nitrogen gas and water.

2.1.7 Outputs, Discharges, and Wastes

Table 2.1.1 includes a summary of discharges and wastes for the proposed project during the demonstration. Also presented in the table are the discharges and wastes for the proposed project in conjunction with the related action (Section 2.2) and those of the existing Unit 1 for comparison.

2.1.7.1 Air Emissions

Based on a 90% capacity factor, air emissions from the proposed project would include approximately 1,650 tons per year of SO_2, 990 tons per year of NO_x, 121 tons per year of particulate matter, 1,533 tons per year of carbon monoxide (CO), and 61 tons per year of VOCs. Emissions would be nearly independent of fuel type because emissions controls would be adjusted (i.e., tightened or relaxed) based on fuel type to achieve the same level of emissions. Trace emissions of other pollutants would include beryllium, sulfuric acid mist, mercury, hydrochloric acid,

Table 2.1.2. Analysis of the composition of coal and petroleum coke expected to be received for the proposed project at Northside Generating Station

Characteristic	Coal			Petroleum coke		
	Minimum value	Typical value	Maximum value	Minimum value	Typical value	Maximum value
Heating value, Btu/lb	10,000	11,600	—	13,000	14,360	—
Analysis, percent by weight						
Moisture	—	12	15	—	6	15
Carbon	49	65	86	78	83	89
Hydrogen	3.2	4.6	6.0	3.2	3.7	5.8
Nitrogen	0.4	1.3	1.9	0.4	1.7	2.0
Sulfur	0.5	0.7	4.5	3	4.5	8
Ash	7	8	15	—	0.4	3
Oxygen	3.0	8.0	9.8	0.1	0.5	1.8
Chlorine	—	0.04	0.3	—	0.01	—

Source: JEA (formerly the Jacksonville Electric Authority).

hydrofluoric acid, benzene, arsenic, and various heavy metals. The project also would emit about 2,293,100 tons per year of CO_2. Although CO_2 is not considered an air pollutant, it is a contributor to the greenhouse effect that is suspected to cause global warming and climate change (Mitchell 1989).

2.1.7.2 Liquid Discharges

Condenser Cooling Water

The total flow of once-through, noncontact cooling water required to operate Northside Generating Station (all 3 units) at full load would average 827 Mgd (574,000 gpm). This cooling water would be drawn from the back channel of the St. Johns River and then 815 Mgd (566,000 gpm) would be returned to the river after passing through the condensers (Figure 2.1.8). Prior to circulating through the condensers, the cooling water would be treated intermittently (2 hours or less per day) with sodium hypochlorite (NaOCl) or sodium bromide (NaBr), which are biocides to prevent biological growth on heat exchanger tubes.

Circulating Water Pumps, Irrigation, and Car Wash

Groundwater from the upper Floridan aquifer currently is used to lubricate the seals and bearings of the circulating water pumps, to irrigate plants and grass as required, and to clean vehicles. Vehicles that are parked at Northside Generating Station are placed in covered areas and/or routinely rinsed to avoid the possibility of accelerated corrosion resulting from existing facility emissions into the moist ocean air. The freshwater effluents associated with these uses are discharged untreated into the estuarine St. Johns River. During the demonstration, the circulating water pumps at Northside Generating Station would use a total of 0.14 Mgd (96 gpm) for lubrication of the seals. Rather than being obtained directly from groundwater (as is the current practice), this water would be reused by Northside after use by the adjacent St. Johns River Power Park. This water would not come into contact with oil or grease and would be discharged at this same rate into the back channel of the St. Johns River after passing through the pumps. Approximately 90% of the groundwater used for irrigation and to wash cars either transpires or evaporates into the atmosphere, respectively. Untreated effluent resulting from irrigation and car washing enters the St. Johns River at a rate of 0.001 Mgd (about 1 gpm). The proposed project would have no effect on the effluent discharges associated with irrigation and rinsing of cars. In a change unrelated to the proposed project, JEA plans to modify the car wash drains to divert them from the St. Johns River. This effluent would be sent to a retention basin, from which it would either evaporate or be reused for irrigation.

Wastewater Streams

Northside Generating Station would continue to treat wastewater streams to reduce metals, oil and grease, and suspended solids and to adjust pH. Wastewater from the following activities would be routed to the chemical waste treatment facility: demineralizer regeneration, boiler blowdown, storm drains from the power block area, waste streams from the ash storage area, seal water, carbon purifier backwash, equipment and floor drains, fuel storage building sumps, and air preheater and boiler wash (Figure 2.1.8). The wastewater is currently discharged to evaporation/percolation ponds after being processed through the chemical waste treatment facility; however, the system would be modified so that most of the water from the system would be reused within the scrubber and ash conditioning systems. Supernatant from lined settling ponds would be directed to the reuse tank for use in the scrubber system. Approximately 3% of the treated wastewater in the existing system would be recirculated and reused as air preheater and boiler wash.

The supernatant from the settling basins would be collected in a reuse tank. A filtration unit would receive the water collected in the reuse tank and designated reuse water received from the St. Johns River Power Park. Most of the filtered water exiting the filtration unit would be directed to the polishing scrubber, while the remaining water would be used to hydrate and moisten the ash for easier handling. The reused water used in the polishing scrubber would either evaporate and exit through the stack into the atmosphere, or combine with anhydrite to form solid gypsum combustion by-products. Most of the reused water for ash conditioning would also combine with calcium oxide and anhydrite to form hydrated compounds. The cleaning water for the filtration unit would be routed to the head of the chemical waste treatment system. A separate filtration unit would be used to treat the water recycled from the St. Johns River Power Park for the circulating water pump seals. The cleaning water from this unit would also be routed to the head of the chemical waste treatment system.

Northside Generating Station currently treats an average of 0.42 Mgd (293 gpm) of wastewater at the chemical waste treatment system (Figure 2.1.9). During normal conditions, all of the wastewater [except 0.01 Mgd (7 gpm) that is recycled for boiler wash] discharges to the surficial aquifer through the unlined settling basins and the evaporation/percolation ponds. During abnormal overflow conditions, surface water may discharge to the San Carlos Creek from an overflow spillway on the evaporation/percolation ponds and/or a riser in the settling basins. After repowering, the only effluent that would normally be routed to the evaporation/percolation ponds would be 0.07 Mgd (48 gpm) from the chemical waste treatment system (Figure 2.1.8). However, the evaporation/percolation ponds would receive overflow of chemical waste treatment effluent from the lined settling basins if the reuse tank were full (e.g., during periods of abnormally high wastewater production or periods of low demand from the polishing scrubber).

Sanitary Wastewater

Northside Generating Station currently discharges 0.005 Mgd (4 gpm) of treated sanitary effluent into the back channel of the St. Johns River (Figure 2.1.9). There would be no change in this operation as a result of the proposed project.

Northside Generating Station

Existing Water Balance (based on 1996)

Flows in gpm

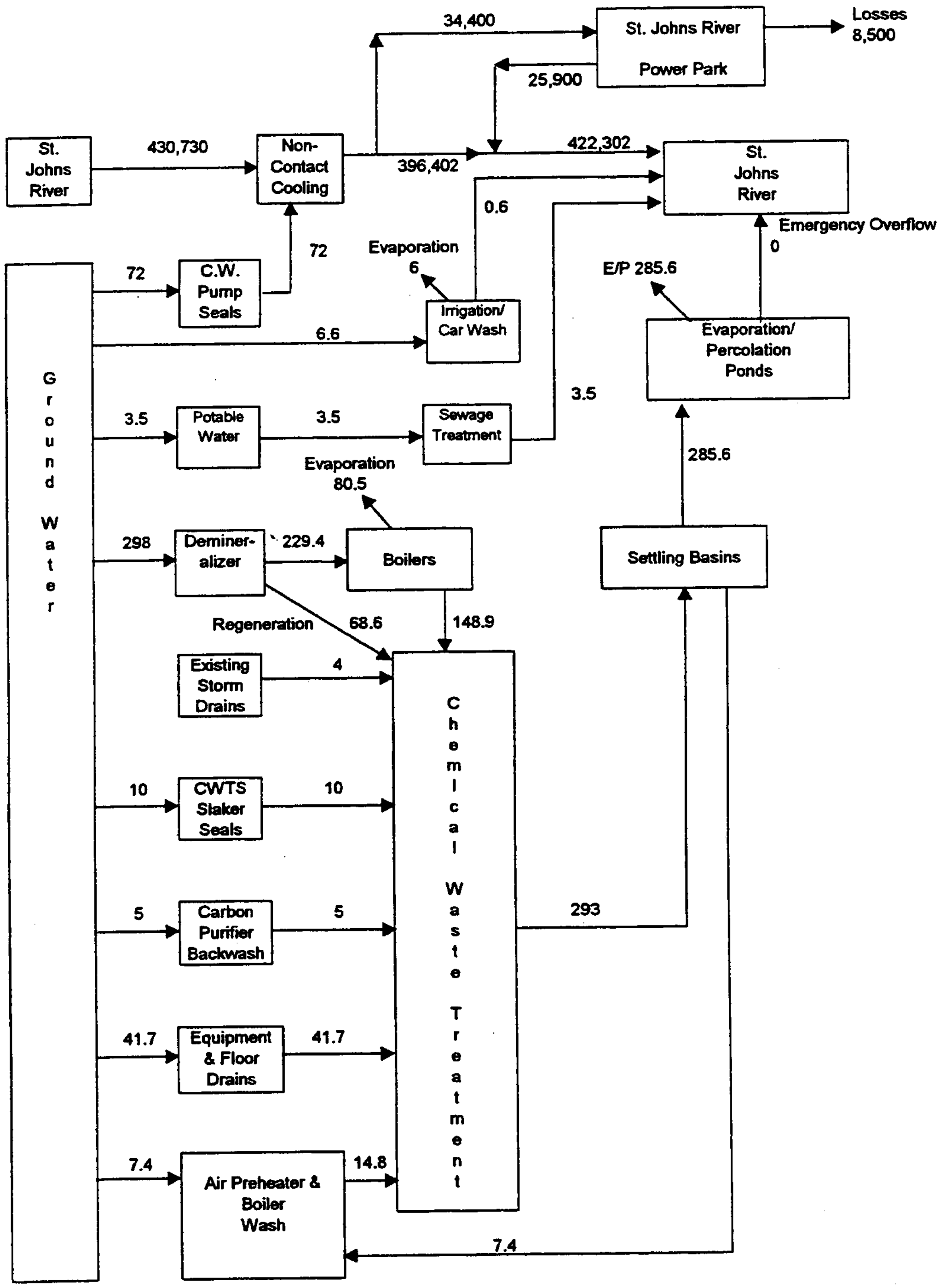


Figure 2.1.9. Water flow diagram that depicts water requirements and discharges at the existing Northside Generating Station.

2.1.7.3 Solid Wastes

During construction, the existing covered parking lot would be dismantled and removed. Asphalt from the parking lot would be recycled in Jacksonville and metal would be sold as scrap. Assuming a 90% capacity factor during operation, the proposed project would generate about 57,012 tons per year of fly ash and 105,880 tons per year of bottom ash if coal were used alone for an entire year or 109,352 tons per year of fly ash and 170,411 tons per year of bottom ash if petroleum coke were used alone for an entire year. Because both fuels would be used during the course of a year, actual amounts would be between this range. Collected fly ash would be recirculated to the polishing scrubber for further use in SO_2 removal. The calcium sulfite and calcium sulfate generated by the polishing scrubber would be captured as fly ash by the particulate collector (the electrostatic precipitator or fabric filter). Therefore, the given fly ash amounts include fly ash captured by the particulate collector from both the CFB combustor and the polishing scrubber. The fly ash and bottom ash would be stored in separate silos at the site and periodically hauled by truck to the adjacent 40-acre storage area in the northwest corner of the Northside Generating Station property (Figure 3.4.2). At this storage area, the fly ash and bottom ash would be commingled to make a saleable by-product.

The preferred alternative for management of this combustion ash would be to sell it as a by-product and transport it by truck to offsite customers. If markets cannot be established, excess material would be disposed of either on the site or off the site in accordance with appropriate solid waste disposal requirements (Section 5).

There would be no waste generated by the selective non-catalytic reduction system (Section 2.1.3). Because the system would be non-catalytic, there would be no need to replace a catalyst.

2.1.7.4 Toxic and Hazardous Materials

Several materials considered toxic or hazardous would be required for or generated by the proposed project. These materials, which are currently used at Northside Generating Station (primarily for water chlorination and for maintenance and cleaning activities), would be transported by truck to and from the station. Approximately 11 tons per year of chlorine gas would be used at Northside Generating Station to treat the potable and process water that would be withdrawn from the four deep wells that tap the upper Floridan aquifer. Approximately 1,648 tons per year of aqueous ammonia would be used as reagent for the selective non-catalytic reduction system. The ammonia would be stored in a 40,000-gal horizontal cylindrical tank with secondary containment of sufficient volume to hold the entire contents of the tank in the unlikely event of a rupture. A Spill Prevention, Control, and Countermeasures Plan (SPCCP) (40 CFR Part 112) would be developed, and the ammonia storage would comply with Emergency Planning and Community Right-to-Know Act (EPCRA) notification requirements.

On an annual basis, the other materials would include an estimated eight 55-gal drums of paint product, three 55-gal drums of paint solvent, 30 gal of chlorinated solvents, two 55-gal drums of laboratory solvents and rags, and 2,500 lb of Safety-Kleen solvent. All chemicals would be properly labeled and stored according to local fire codes and Occupational Safety and Health Administration (OSHA) requirements. Wastes from these materials would be transported and disposed of in approved offsite waste disposal areas by licensed disposal contractors.

2.2 RELATED ACTION

In addition to the proposed project of repowering Unit 2, JEA plans to repower the currently operating Unit 1 steam turbine without cost-shared funding from DOE. More precisely, the DOE cost-shared funding would be applied to the cost of systems distinct to Unit 2, plus 50% of the cost associated with systems common to Units 1 and 2; DOE cost-shared funding would not be applied to the cost of systems distinct to Unit 1.

The repowered Unit 1 would be essentially identical to the repowered Unit 2. The CFB combustor for the repowered Unit 1 would be located immediately to the west of the existing Unit 3 on the section of the property that currently consists primarily of a covered parking lot for employees and immediately to the south of the Unit 2 CFB combustor (Figure 2.1.3). Piping and related infrastructure would be constructed to link the Unit 1 CFB combustor with the existing Unit 1 steam turbine. Common systems for Units 1 and 2 include the solid fuel delivery and storage facilities, limestone preparation building, ash storage facilities, and electrical substation. Separate systems include the CFB combustor buildings, limestone silos, air heaters, lime silos, polishing scrubbers, ash collection bins, and baghouses or electrostatic precipitators. The repowered units would be served by a single new 495-ft stack with separate flues for each unit.

Construction on the repowered Unit 1 would lag construction on the repowered Unit 2 by about 4–6 months overall. Craft workers would work on Unit 2 first and then move over to Unit 1. This approach is very efficient because the workers can immediately start work on Unit 1 upon completion of their tasks on Unit 2 without going to another job site between tasks. Construction on many items, such as foundations, would proceed on both units nearly simultaneously. The existing Unit 1 would continue in operation as the demonstration commences on the repowered Unit 2. Unit 1 would burn a blend of natural gas and fuel oil with a sulfur content averaging no more than 0.13% to ensure that the maximum 24-hour average SO_2 concentration would not exceed the corresponding Florida standard (see Section 4.1.2.2). The existing Units 1 and 3 would be operated to meet the target established by JEA's management of a 10% reduction in total annual emissions of SO_2, NO_x, and particulate matter from Northside Generating Station, starting with the year that the demonstration begins. About 6–12 months later, Unit 1 would cease operation and the new CFB combustor would be connected to repower the existing Unit 1 steam turbine.

This EIS evaluates the Unit 1 repowering as a related action to the proposed project. The analyses of environmental consequences (Section 4) initially discuss the proposed project alone and then include an evaluation of the proposed project in conjunction with this related action.

2.3 ALTERNATIVES

Section 102(2)(C) of NEPA requires an EIS to include a discussion of reasonable alternatives to the proposed action. The term "reasonable alternatives" is not self-defining, but rather must be determined within the context of the proposed action. The goals of the federal action establish the limits of its reasonable alternatives. Congress established the CCT Program with a specific goal— to make available to the U.S. energy marketplace a number of advanced, more efficient, economically feasible, and environmentally acceptable coal technologies. DOE's purpose in considering the proposed action (to provide cost-shared funding) is to demonstrate the CFB combustion technology's viability in achieving the goal for the program. Reasonable alternatives to this proposed action must be capable of meeting this purpose.

Congress also directed DOE to pursue the goals of the legislation by providing partial funding for projects owned and controlled by nonfederal-government participants. This statutory requirement places DOE in a much more limited role than if the federal government were the owner and operator of the project. In the latter situation, DOE would ordinarily be required to review a wide variety of reasonable alternatives to the proposed action. However, in dealing with a nonfederal applicant, the scope of alternatives is necessarily more restricted. It is appropriate in such cases for DOE to give substantial weight to the needs of the proposer in establishing reasonable alternatives to the proposed action. In addition, under the CCT Program, DOE's role is limited to approving or disapproving the project that JEA has proposed.

Thus, the only reasonable alternative to the proposed action is the no-action alternative, including three scenarios reasonably expected as a consequence of the no-action alternative (Section 2.3.1).

2.3.1 No-Action Alternative

Under the no-action alternative, DOE would not provide cost-shared funding for the proposed CFB combustor project. The PEIS for the CCT Program (DOE 1989) evaluated the programmatic consequences of no action (Section 1.5). Under the no-action alternative for the proposed project, three reasonably foreseeable scenarios could result.

First, JEA could repower the existing Unit 2 steam turbine without DOE funding, thereby accepting more of the risk associated with demonstrating the CFB combustor. JEA would also proceed with the related action of repowering Unit 1. Under this scenario, construction materials and activities and project operations would be the same as for the proposed project. Fuel requirements would be similar except that the blend of coal to petroleum coke might be slightly different, particularly during the first 2 years of operation. Under this scenario, more of the solid fuel used each year throughout the lifetime of the facility could be petroleum coke. Therefore, there could be less train traffic and more ship traffic to deliver the fuel. The same amount of electricity would be generated and environmental impacts would be very similar to those of the proposed project.

Related to this first scenario, JEA may proceed with the proposed project, including commencing construction, at their own risk without DOE funding prior to the completion of the NEPA process. In the event of this occurrence, DOE would still independently make a decision on whether or not to provide cost-shared funding to design, construct, and demonstrate the proposed project. If DOE decides to provide cost-shared funding for the proposed project, then the proposed action would be implemented as construction continued. If DOE decides not to provide cost-shared funding for the proposed project, then JEA would continue construction and operation of the project as described in the first scenario. JEA has indicated plans to start construction prior to the completion of the NEPA process in February 2000.

Second, rather than repowering Unit 2, JEA could construct and operate a new gas-fired combined cycle facility at Northside Generating Station or at one of their other existing power plants. The natural gas would drive a gas combustion turbine and the heat from combustion would be used to produce steam that would drive a steam turbine. Based on modeling projections by JEA, the facility would be expected to generate approximately 230 MW of electricity.

Under this scenario, Northside Unit 1 would remain in its current oil- and gas-fired configuration, and JEA would not proceed with the related action of repowering Unit 1. Based upon the projected cost of natural gas and the combined cycle unit efficiency, the cost of generating electricity at the new combined cycle facility was projected to be in the same range as the existing oil-fired units. This resulted in a projected capacity factor in the 60% range for the new combined cycle unit. The difference in generating output between the proposed combined cycle unit operating at a 60% capacity factor and the two proposed CFB combustors operating at a 90% capacity factor would be supplied by operating the existing units at higher capacity factors, by purchasing electricity from other utilities, or most likely by a combination of these two options. If the existing Northside units were to remain operating at their historical levels, then the addition of a combined cycle unit would result in an increase in JEA emissions. The more likely scenario is that the existing units would operate at higher capacity factors than in recent years, resulting in a larger increase in emissions compared with historical levels and an even larger increase of most pollutants compared with JEA emissions expected following the repowering of Units 1 and 2 with CFB combustors. Therefore, even though air emissions of most pollutants from the combined cycle facility alone would be less than corresponding emissions from a CFB combustor alone, the emissions from the existing oil-fired units would result in greater overall emissions under the combined cycle facility scenario.

Construction activities and operations would be similar for the gas-fired combined cycle facility and the CFB combustors but with notable differences related to fuel, sorbent, and ash handling and storage facilities. Under the combined cycle facility scenario, no coal, petroleum coke, limestone, or lime would be used. Because the natural gas would be delivered by pipeline and no sorbent would be used, there would be no train, ship, or truck traffic associated with fuel and sorbent delivery. No combustion ash would be generated and there would be no truck traffic to remove ash from the site.

This scenario would not contribute to the CCT Program goal of demonstrating advanced, more efficient, economically feasible, and environmentally acceptable coal technologies.

Third, rather than repowering Unit 2, JEA could purchase electricity from other utilities to meet JEA's projected demand. Under this scenario, no construction activities or changes in current operations would occur within the JEA system of power plants, including Northside Generating Station. There would be no change in current environmental conditions at the site, and the impacts would remain unchanged from the baseline conditions. JEA would not proceed with the related action of repowering Unit 1. There could be construction activities or changes in operations at the other utilities providing electricity to JEA if the electricity were not already available.

This scenario would not contribute to the CCT Program goal, would not provide employment for construction workers in the Jacksonville area, and would not result in reductions of atmospheric emissions or groundwater use at Northside Generating Station. Moreover, existing Units 1 and 3 might be required to operate at capacity factors greater than historical levels if JEA were unable to purchase sufficient electricity from other utilities. Under those circumstances, annual air emissions and groundwater consumption would increase.

Table 2.3.1 presents a comparison of potential impacts between the proposed project and the no-action alternative.

2.3.2 Alternatives Dismissed from Further Consideration

The following sections discuss alternatives that were initially identified and considered by DOE or JEA, and alternatives that were raised during the scoping process. The project as proposed by JEA and Foster Wheeler meets the needs outlined in the CCT solicitation's Program Opportunity Notice that was issued by DOE in February 1986 (Section 1.1). DOE's role is limited to providing the cost-shared funding for JEA's proposed project. As such, reasonable alternatives to the proposed project are narrowed and the following alternatives have been dismissed from further consideration.

2.3.2.1 Alternative Sites

During the site selection process for the proposed project, JEA considered the sites of their existing power plants and a hypothetical undeveloped site. JEA owns and operates four power plants: Northside, Southside, Kennedy, and the St. Johns River Power Park (a joint venture between JEA and Florida Power & Light, as described in Section 2.1.1). Southside Generating Station is located in downtown Jacksonville and Kennedy Generating Station is located about 4 miles northeast of the downtown area.

The available infrastructure at the existing sites offers a considerable advantage. JEA eliminated the undeveloped site from further consideration because it was economically unattractive and the

Table 2.3.1. A comparison of potential impacts between the proposed project and the no-action alternative

Resource	Impacts of the proposed project	Impacts of the no-action alternative		
		Repower Unit 2 steam turbine without DOE funding	Construct new gas-fired combined cycle facility	Purchase electricity from other utilities
Aesthetics	Because the industrial appearance of the site would not be appreciably altered, the aesthetic character of the Northside area would not be degraded.	Impacts would be similar to those resulting from the proposed project.	Impacts would vary slightly depending on stack height for the facility and the existing aesthetic character of the project location.	Impacts would remain essentially unchanged from existing conditions.
Land use	The proposed project is not expected to alter land use patterns in Duval County. No major impacts to existing land use are expected as a result of the total of approximately 75 acres of land used by the proposed facility. The 40-acre ash storage area would require harvesting of approximately 28 acres of pine plantation and loss of 10 acres of upland hardwood/pine habitat and 1.8 acres of isolated hardwood wetland habitat.	Impacts would be similar to those resulting from the proposed project.	Impacts would be dependent on the project location, but probably would be similar to those resulting from the proposed project.	Impacts would remain essentially unchanged from existing conditions.

Table 2.3.1. Continued

		Impacts of the no-action alternative		
Resource	Impacts of the proposed project	Repower Unit 2 steam turbine without DOE funding	Construct new gas-fired combined cycle facility	Purchase electricity from other utilities
Atmospheric resources and air quality	During construction, temporary and localized increases in gaseous pollutants and fugitive dust would result from exhaust emissions, excavation, and earthwork. During operations, no major impacts would be expected relative to Prevention of Significant Deterioration increments, National Ambient Air Quality Standards, visibility, acidic deposition, and global climate change. No detectable change in ozone concentrations would be expected from the proposed project. For other criteria pollutants, some slight degradations in air quality at some locations and times would be offset by corresponding beneficial impacts at other locations and times (associated with JEA management's target of a 10% reduction in annual emissions of sulfur dioxide, oxides of nitrogen, and particulate matter at Northside Generating Station). The cancer risk of dioxins, furans, and other carcinogenic substances emitted during operation of the proposed project was calculated to be approximately 1 in 1 million per year; given the upper-bound assumptions in the estimate, the risk would probably be less.	Impacts would be similar to those resulting from the proposed project.	Changes in air quality would depend on the project-specific nature and location of the facility. Even though air emissions of most pollutants from the combined cycle facility alone would be less than corresponding emissions from a CFB combustor alone, the cumulative effects from adding a new gas-fired combined cycle facility to the existing oil-fired units at Northside Generating Station would result in greater overall emissions.	Impacts would remain essentially unchanged from existing conditions. Existing Units 1 and 3 might be required to operate at capacity factors greater than historical levels if JEA were unable to purchase sufficient electricity from other utilities. Under those circumstances, annual air emissions would increase.

Table 2.3.1. Continued

Resource	Impacts of the proposed project	Impacts of the no-action alternative		
		Repower Unit 2 steam turbine without DOE funding	Construct new gas-fired combined cycle facility	Purchase electricity from other utilities
Surface water resources	During construction, no surface water would be used and no measurable impacts to surface water bodies would be expected. During operations, the proposed project would increase the station's demand for noncontact cooling water obtained from the St. Johns River and heat discharged to the St. Johns River; however, the size of the thermal plume created by the station would not increase because simultaneous operation of all three units would increase the discharge velocity and enhance mixing. Runoff, stormwater discharges, and potential failures of power plant piping would not be expected to cause major impacts. Adverse impacts on water quality would be unlikely, although temporary and localized increases in turbidity and fine suspended sediment would result from dredging activities for the new fuel and limestone unloading dock (Option 2).	Impacts would be similar to those resulting from the proposed project.	Impacts would be similar to those resulting from the proposed project. There would be no dredging activities to deepen the channel for a new dock, which could temporarily affect water quality; however, the frequency of dredging required to maintain the existing channel would be greater than the frequency required for the proposed project's new dock.	Impacts would remain essentially unchanged from existing conditions.

Table 2.3.1. Continued

		Impacts of the no-action alternative		
Resource	Impacts of the proposed project	Repower Unit 2 steam turbine without DOE funding	Construct new gas-fired combined cycle facility	Purchase electricity from other utilities
Floodplains and wetlands	No impacts from flooding would be expected to occur, and proposed activities would have negligible effect on floodplain encroachment. The possible occurrence of a category 3, 4, or 5 hurricane in Jacksonville is a low-probability, high-consequence event. Impacts to wetlands from the proposed project would be minor. The purchase of slightly greater than 3 acres of wetlands from an offsite mitigation bank and the restoration of 1 acre of salt marsh would result in a net gain in the amount of wetlands.	Impacts would be similar to those resulting from the proposed project.	Floodplain impacts would be similar to those resulting from the proposed project. Depending on the site, ecological impacts to wetlands probably would be negligible.	Impacts would remain essentially unchanged from existing conditions.
Ecological resources, terrestrial	The ash storage area would require harvesting of approximately 28 acres of pine plantation and loss of 10 acres of upland hardwood/pine habitat. Disturbance or removal of this acreage would not have major impacts.	Impacts would be similar to those resulting from the proposed project.	Depending on the site, impacts probably would be negligible because no solid fuel receiving and storage areas and no ash storage areas would be required. However, impacts might result from construction of an offsite pipeline to deliver natural gas.	Impacts would remain essentially unchanged from existing conditions.

Table 2.3.1. Continued

Resource	Impacts of the proposed project	Impacts of the no-action alternative		
		Repower Unit 2 steam turbine without DOE funding	Construct new gas-fired combined cycle facility	Purchase electricity from other utilities
Ecological resources, aquatic	Thermal discharges from the proposed project are not expected to have a measurable effect on the aquatic biota of the area. Loss of fish and shellfish because of operation of the cooling water intake system is not expected to have a measurable impact on populations of aquatic biota in the site vicinity. Any pollutants mobilized from sediments during dredging activities for the new fuel and limestone unloading dock (Option 2) would not occur in sufficient concentrations to cause substantial impacts on resident biota.	Impacts would be similar to those resulting from the proposed project.	Impacts would be similar to those resulting from the proposed project. There would be no dredging activities to deepen the channel for a new dock, which could mobilize contaminants; however, the frequency of dredging required to maintain the existing channel would be greater than the frequency required for the proposed project's new dock.	Impacts would remain essentially unchanged from existing conditions.
Ecological resources, threatened and endangered species	No measurable impacts to threatened or endangered species are expected to result from construction and operation of the proposed project. Impacts to manatees would be very small or non-existent because of a lack of preferred habitat and feeding areas near the site, the construction design of the docking facilities, and the maintenance of a relatively small but continuous thermally enhanced area during cooler periods of the year. Regarding biodiversity, the ecosystem types that occur in the site vicinity would not be measurably affected by the proposed project.	Impacts would be similar to those resulting from the proposed project.	Impacts would be dependent on the project location, but probably would be similar to those resulting from the proposed project.	Impacts would remain essentially unchanged from existing conditions.

Table 2.3.1. Continued

Resource	Impacts of the proposed project	Impacts of the no-action alternative: Repower Unit 2 steam turbine without DOE funding	Impacts of the no-action alternative: Construct new gas-fired combined cycle facility	Impacts of the no-action alternative: Purchase electricity from other utilities
Transportation and traffic	Traffic congestion probably would occur during the peak construction period. During operations, increased rail traffic is not expected (based on economic projections), but if it occurs would exacerbate current community concerns regarding vibration, noise, and blocked road crossings. The increased use of waterborne transport would not result in major impacts and would mitigate impacts from rail traffic by providing an alternative to rail transport.	Traffic congestion during construction would be similar to that of the proposed project. Because fewer train trips would be expected under this scenario (assuming less coal and more petroleum coke were used), the potential impacts from noise, vibration, and blocked crossings would be reduced.	Traffic congestion during construction would depend on the project location; compared to the proposed project, congestion could be reduced at Northside if a smaller workforce were required. Because there would be no train, ship, or truck traffic associated with fuel and sorbent delivery or ash removal, the potential impacts from noise, vibration, and blocked crossings would be reduced.	Impacts would remain essentially unchanged from existing conditions.

Table 2.3.1. Continued

Resource	Impacts of the proposed project	Impacts of the no-action alternative		
		Repower Unit 2 steam turbine without DOE funding	Construct new gas-fired combined cycle facility	Purchase electricity from other utilities
Waste management	Combustion ash would be stored on the site in a double-lined storage area or sold, although its marketability has not yet been fully determined. If stored on the site, major impacts are unlikely to occur from leaks or leachate. Sufficient capacity is available from a variety of onsite and offsite locations to dispose of combustion ash during the 30-year lifetime of the project. No major impacts would be expected from the various liquid waste streams associated with the proposed project.	Impacts would be similar to those resulting from the proposed project.	Impacts would remain essentially unchanged from existing conditions.	Impacts would remain essentially unchanged from existing conditions.
Groundwater	Operation of the proposed project would reduce the Northside Generating Station's usage of groundwater from the upper Floridan aquifer by 10% —a reduction that would decrease the rate of decline of the potentiometric surface of that aquifer. As a result, more groundwater would be available to the station and other local users, and water quality of the aquifer would be stabilized because of reduced influx of brackish or saline groundwater from deeper aquifers.	Impacts would be similar to those resulting from the proposed project.	Impacts would be expected to be minor.	Impacts would remain essentially unchanged from existing conditions.

Table 2.3.1. Continued

Resource	Impacts of the proposed project	Impacts of the no-action alternative: Repower Unit 2 steam turbine without DOE funding	Impacts of the no-action alternative: Construct new gas-fired combined cycle facility	Impacts of the no-action alternative: Purchase electricity from other utilities
Cultural resources	Sites of cultural significance could be located in the vicinity of the proposed project. Under the terms of the Submerged Lands & Environmental Resource Permit (SLERP) that would be issued by the Florida Department of Environmental Protection (FDEP), JEA would be required to notify the appropriate agencies immediately upon discovery of any archaeological artifacts on the project site.	Impacts would be similar to those resulting from the proposed project.	Impacts could be less if there were fewer land disturbances to construct support facilities but could be greater if more land were disturbed during construction of an offsite pipeline to deliver natural gas.	Impacts would remain essentially unchanged from existing conditions.
Socioeconomic resources and environmental justice	Construction and operation would not result in appreciable impacts to population, employment, income, housing, local government revenues, or public services. No disproportionately high and adverse impacts to low income or minority populations would occur. Community concerns could arise as a result of increased rail or road traffic.	Impacts would be similar to those resulting from the proposed project.	The size of the construction and operations workforce would likely be similar or somewhat smaller. Potential community concerns would be diminished or eliminated because rail and road traffic to deliver solid fuel and limestone and remove ash would not be required.	Impacts would remain essentially unchanged from existing conditions.

Table 2.3.1. Continued

Resource	Impacts of the proposed project	Impacts of the no-action alternative		
		Repower Unit 2 steam turbine without DOE funding	Construct new gas-fired combined cycle facility	Purchase electricity from other utilities
Noise	Except during steam blowouts, and possibly during operation of equipment used to construct a nearby segment of the conveyor under Option 2, construction noise should not appreciably affect the background noise of nearby residences or exceed levels in Rule 4, Noise Pollution Control, promulgated by the Jacksonville Environmental Protection Board. Operational noise levels would not be appreciably different from those currently occurring at the site. JEA would install baffle silencers for the fans of the proposed facility and enclose the coal and limestone crushers in a sound-insulating building to comply with the city of Jacksonville noise ordinance level of 60 dB(A) at any residence. The increased movement of trains through the local area would be accompanied by high-decibel train whistles and rattling rail cars. One local resident has reported the volume of the former as being 108 dB(A) and the latter as being up to 85 dB(A). Additional train noise could be minimized by relying more heavily on barges and ships for coal transport.	Impacts would be similar to those resulting from the proposed project, except that less train trips and related train noise would be expected (assuming less coal and more petroleum coke were used).	Impacts from construction noise would probably be less because no conveyor would be constructed to transport solid fuel and limestone. However, additional noise could be generated during construction of an offsite pipeline to deliver natural gas. Because there would be no train, ship, or truck traffic associated with fuel and sorbent delivery or ash removal, noise levels during operations would be less than those resulting from the proposed project.	Impacts would remain essentially unchanged from existing conditions.

Table 2.3.1. Continued

		Impacts of the no-action alternative		
Resource	Impacts of the proposed project	Repower Unit 2 steam turbine without DOE funding	Construct new gas-fired combined cycle facility	Purchase electricity from other utilities
Electromagnetic fields	The proposed project would not change exposure levels to electromagnetic fields for the majority of electric consumers. No new transmission lines would be required. Public health impacts, if any, would be small.	Impacts would be similar to those resulting from the proposed project.	Impacts would be similar to those resulting from the proposed project. The geographical distribution of impacts, if any, would be different if the facility were constructed at another site because the electricity would be transmitted on different transmission lines.	Impacts would be similar to those resulting from the proposed project. The geographical distribution of impacts, if any, would be different because the electricity would be transmitted on different transmission lines.
Human health and safety	Potential worker health impacts from construction are expected to be limited to normal hazards associated with construction. Approximately 15 injuries would statistically be expected to occur.	Impacts would be similar to those resulting from the proposed project.	Impacts would be similar to those resulting from the proposed project.	Impacts would remain essentially unchanged from existing conditions at and near Northside Generating Station.

Table 2.3.1. Concluded

Resource	Impacts of the proposed project	Impacts of the no-action alternative		
		Repower Unit 2 steam turbine without DOE funding	Construct new gas-fired combined cycle facility	Purchase electricity from other utilities
Cumulative effects	Impacts of the proposed project in conjunction with other regional emission sources would not be appreciably adverse and after implementation of the related action would be beneficial for most air pollutants and locations.	Impacts would be similar to those resulting from the proposed project.	Slight adverse impacts could occur from air emissions that would be expected to increase compared with historical levels because of the operation of the combined cycle facility in addition to the existing Northside units operating at the same or higher capacity factors.	Impacts would remain essentially unchanged from existing conditions, except slight adverse regional impacts to air quality could occur if new fossil-fired facilities were operated to provide electricity to JEA.

environmental impacts resulting from construction and operation of the project were expected to be considerably greater than impacts associated with repowering a unit at an existing site.

An important consideration during site selection was to meet DOE's purpose for the proposed project: to generate technical, environmental, and financial data from the design, construction, and operation of facilities at a sufficiently large enough scale to allow the power industry to assess the potential of CFB combustion technology for commercial application (Section 1.3). Specifically, the proposed project should take the next step in size by demonstrating the viability of the technology within the range of 250 to 400 MW. This consideration eliminated all sites except Northside Generating Station because the largest unit at Southside is 150 MW, the largest unit at Kennedy is 134 MW, and the twin units at the Power Park are each 660 MW. In addition, because the Power Park units are relatively new and efficient, they are not serious contenders for repowering. The idle 297.5-MW Unit 2 at Northside is an ideal candidate based on its size. Another advantage of Northside Generating Station over Southside and Kennedy is the availability of space for solid fuel and limestone storage facilities.

Based on the above considerations, JEA selected Northside Generating Station as the site for the proposed project. Other sites are not reasonably foreseeable alternatives and are not evaluated in this EIS.

2.3.2.2 Alternative Technologies

As discussed in Section 1.3, the proposed project was selected to demonstrate CFB combustion technology. Other CCT projects would not achieve this goal. The PEIS evaluated the potential environmental consequences of widespread commercialization of each of 22 successfully demonstrated clean coal technologies in the year 2010 (Section 1.5). The CCT preselection reviews included environmental comparisons of proposals submitted in response to each solicitation's Program Opportunity Notice (Section 1.5). The projects selected for demonstration are not considered alternatives to each other. As with other CCT projects, the use of other technologies and approaches which do not use coal (e.g., natural gas, wind power, solar energy, and conservation) to meet JEA's need for power (Section 1.4.2) would not achieve the goal of demonstrating CFB combustion technology.

2.3.2.3 Other Alternatives

Other alternatives, such as delaying or reducing the size of the proposed project, have been dismissed as not reasonable. Delaying the project would not result in any reduction of environmental impacts once the project is implemented but would adversely affect JEA's ability to meet the needs of its customers. The design size for the proposed project was selected because it is large enough to show utilities that the technology, once demonstrated at this scale, could be applied without further scale-up to many similar sized combustors (Section 1.3).